SEED-FLAX PRODUCTION

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FLAXSEED is produced principally in Minnesota, North Dakota, South Dakota, and Montana. Since 1909 the production of flaxseed has not equaled the demand, and in 1915 it was little more than half the quantity required by the linseed crushers of the United States.

Flax for seed can be grown profitably on breaking, either of native or tame grass sod, and on old land in the upper Mississippi Valley.

Good, clean commercial seed, if well graded and treated with a formaldehyde solution to prevent disease, can be sown where flax diseases are not serious. Where these diseases are specially destructive it is desirable to grow some of the disease-resistant types.

Sow flax on clean land. If grown in rotation with other crops it should follow corn or some other cultivated crop rather than any of the small grains.

Sow with a grain drill on a firm seed bed with a fine surface. To insure satisfactory germination do not sow too deep. An inch is deep enough if there is sufficient moisture for germination at that depth.

Sow early. The seed should be sown as early in spring as the land is prepared and before the surface becomes dry. Sow from 15 to 35 pounds of seed to the acre.

On the small farm, harvest flax with a grain binder. When bound and shocked, the grain is kept from the damp earth and dries more readily after rains. Often the binding attachment is removed, a buncher attached, and the flax dumped in loose bunches on the ground. Sometimes the header can be used to better advantage than the binder in harvesting large acreages. Either the heads are then stacked or a buncher attachment is used and the heads dropped in large bunches.

Keep flax as dry as possible until it is thrashed. The seed flax should be kept from the wet ground, and if stacked should be protected from fall rains.

Keep only clean, plump seed for sowing.

SEED-FLAX PRODUCTION.

CONTENTS.

INTRODUCTION.

Flaxseed production in the United States has always been a pioneer industry. This is due to the fact that the crop does well on new breaking, is readily marketable, and brings a high price in proportion to its bulk. Further, when this crop is grown continuously for several years on the same land certain diseases are likely to become so destructive that the returns are not sufficient for profit. In 1850 the leading States in the production of flaxseed were Ohio and Kentucky; before the end of the nineteenth century the leadership had shifted to North Dakota. During these fifty years Indiana, Illinois, Iowa, and Minnesota successively have been first in the production of this crop.

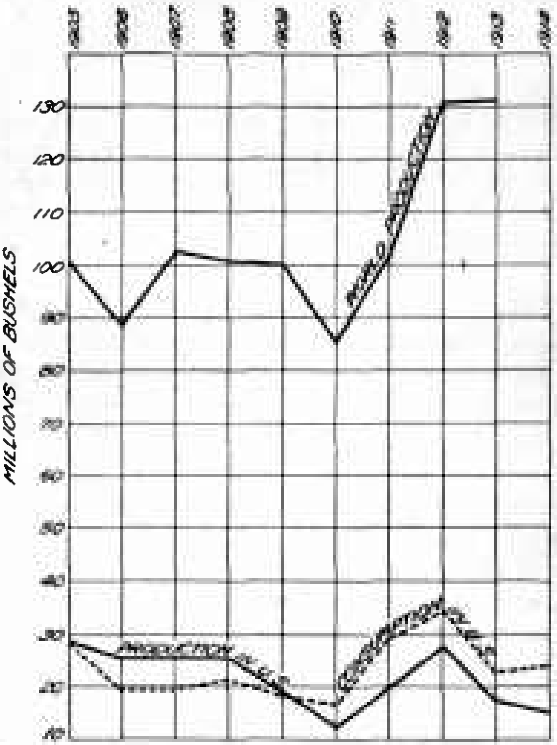

FIG. 1.—Diagram showing the world production of flaxseed, 1905 to 1913, and the production and consumption of flaxseed in the United States, 1905 to 1914, inclusive.

The annual production and consumption of flax in the United States and the annual world production from 1905 to 1914, inclusive, are shown graphically in figure 1. This diagram shows that until

1909 this country exported flaxseed. Since that time the flaxseed crushers of the United States have had to import seed to supply their demand. Until 1914 they depended largely on Canadian-grown seed. In 1915, owing to an adverse season and a small acreage of flax in Canada, the supply from this source was not sufficient for their needs. It was therefore necessary to import seed from other countries. Because of conditions arising from the European war it was possible to obtain seed from Argentina which up to that time had been shipped to England and to continental Europe. Though seed was available at low prices, abnormally high ocean freight rates helped to maintain the price of home-grown seed at a high level.

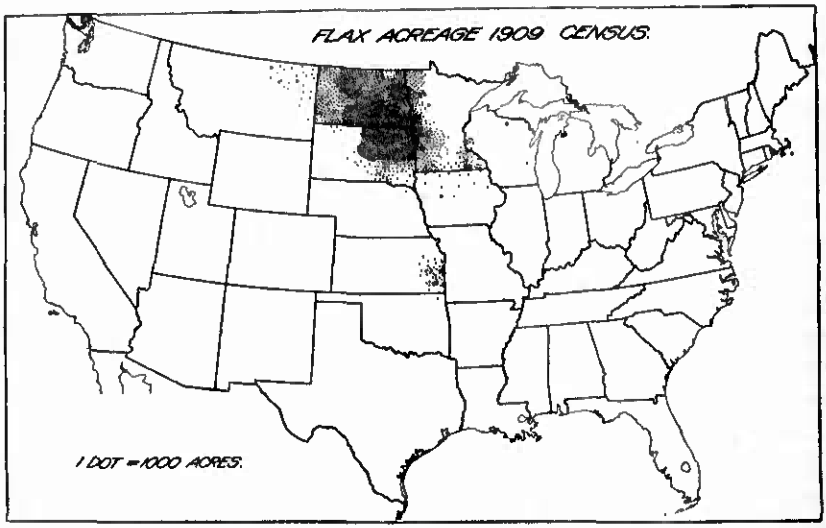

FIG. 2.—Map of the United States, showing the flax acreage according to the census of 1909.

Good prices for flax have therefore been obtained in the United States since 1912, in which year the production in the United States and Canada exceeded the demand, resulting in low prices.

An epidemic of wheat rust in the Northern States in 1916 has again impressed upon the farmer the advisability of crop diversification. With wheat almost a total failure in many sections there is likely to be less dependence in the future on this one cash crop. Though the wheat crop failed, good yields of flax generally were obtained. These good yields and the relatively high price since 1912 have caused the growing of this crop to be looked on with more favor in sections where it can be produced successfully. With the knowledge now available with regard to the advisability of growing flax in rotations of several years' duration and the value of grading, cleaning, seed

treatment, and the proper preparation of the land, the flax crop should take a more prominent place in the permanent agriculture of the North-Central States.

THE FLAX-GROWING AREA.

Figure 2 shows the area devoted to flaxseed production in the United States in 1909. Since that time the center of production has moved farther west. Flax is now most largely grown in Minnesota, the Dakotas, and Montana. Some flax also is produced in Wisconsin, Iowa, eastern Kansas, and the more favorable dry-land areas of Nebraska, Colorado, and Wyoming. It is grown to a limited extent in Idaho, Washington, and Oregon, in which States the acreage will doubtless be increased when better railroad and marketing facilities are furnished. Where proper methods of rotation are practiced it is a profitable crop on old lands. As a cash crop under irrigation in the Northwest it gives much promise in rotation with sugar beets, alfalfa, and corn.

Flax is grown under a wide variety of soil and climatic conditions. West of the Red River valley in North Dakota and in central South Dakota the average annual rainfall ranges from 15 to 20 inches. Here the crop is largely dependent on the rainfall during the growing season. Rapid climatic changes and periods of drought are frequent. Under these conditions flax with short, coarse straw and uneven fiber is produced. As the crop is of little or no value for fiber, the highest yielding seed strains should be grown.

Where the rainfall is more abundant it is possible in some localities to grow flax producing excellent fiber for spinning, and over wider areas with a rainfall of only 25 to 30 inches flax with a fair quality of fiber not suitable for spinning but for other industries which heretofore have used imported flax tow and waste. The growing of flax for fiber and the utilization of the straw of seed flax have recently been discussed in other bulletins.[1]

VALUE OF THE CROP.

Flax has found such favor as a sod crop that its center of production is always near the frontier. With the development of the States in the northern Great Plains area the increase in flax acreage and production for a time was rapid. The supply was larger than the home demand, and prices were not always maintained at a point high enough to enable farmers to grow this crop with profit where land values were comparatively high. For this reason and because disease

[1] Miles, F. C. Fiber flax. U. S. Dept. Agr., Farmers' Bul. 669, 19 p., 10 fig. 1915.
Merrill, J. L. Utilization of American flax straw in the paper and fiber-board industry. U. S. Dept. Agr. Bul. 322, 24 p., 8 fig. 1916.

has reduced the yield in some sections, flax has not found a permanent place in the agriculture of the older States.

If properly handled, flax can be grown with profit in all of the Northeastern and North-Central States, as well as in the area where it is now being produced. Conditions may change so that it will be grown again in this area. At the present time, however, there are few markets east of Minneapolis and Duluth where flax can be sold in less than carload lots, and none at all east of Chicago. Farmers who live east of these cities, therefore, should not grow small acreages. If a large enough acreage is sown to produce seed in carload lots for shipment to wholesale markets at Chicago or Buffalo, the crop can be grown to advantage throughout most of this region. The southern limits of profitable flaxseed production have not been determined. The crop has never been grown commercially for seed south of Kentucky, and in Missouri and Kansas it has not given as good results as in the States farther north.

Table I, compiled by the Bureau of Crop Estimates of the United States Department of Agriculture, compares the acre value of flax, wheat, oats, and barley for the 10-year period 1906 to 1915, inclusive. These figures show that the acre value of flax was the highest of any of these crops in the States of North Dakota, South Dakota, Minnesota, and Wisconsin; second in Nebraska; third in Iowa and Kansas; and fourth in Montana and Missouri. Its poor showing in Montana no doubt results from the fact that flax usually is grown on dry land, while a considerable part of the other crops is produced under irrigation. This is an unfair comparison. In reality, flax is a promising cash crop for the more favorable dry-land portions of this State as well as for the irrigated lands.

TABLE I.—*Farm value of flax per acre in nine States, based on the average annual yields and average farm price per bushel on December 1 of the ten years 1906 to 1915, inclusive, compared with the acre values of wheat, oats, and barley in the same years.*

State.	Flax.	Wheat.	Oats.	Barley.	State.	Flax.	Wheat.	Oats.	Barley.
North Dakota	$12	$10	$9	$10	Iowa	$11	$15	$11	$15
South Dakota	12	10	9	11	Missouri	9	13	10	15
Minnesota	14	12	11	13	Nebraska	12	14	9	10
Montana	14	20	18	19	Kansas	9	12	10	9
Wisconsin	19	16	13	18					

FLAXSEED MARKETS.

The two principal primary flaxseed markets of the United States are Minneapolis and Duluth, Minn. More flaxseed is crushed in Minneapolis and St. Paul than in any other locality in the United States. Seed sent to the Duluth market is cleaned and reshipped to

Chicago, Cleveland, Toledo, Buffalo, New York, and Philadelphia, where other important linseed-oil mills are located. Numerous mills in other cities at various times have been more or less favorably located with regard to the flax-producing areas. These now obtain most of their seed from the two principal flaxseed markets. A small mill at Portland, Oreg., obtains most of its supply from the Orient. Growers in western Montana, Idaho, and other Western States can ship to Portland more economically than to the Minnesota markets.

VARIETIES OF SEED FLAX.

Flax grown commercially in the United States may be divided into three main crops: (1) Seed flax, (2) short fiber flax, and (3) textile fiber flax.

The textile fiber flaxes are not grown for seed, although the seed is a by-product when they are grown for fiber. Small admixtures of this type are usually found in fields grown from commercial seed. This is the only group producing fiber suitable for spinning.

In the short fiber group are to be found such strains as Primost (Minnesota No. 25) and North Dakota Resistant No. 114, distributed by the Minnesota and North Dakota Agricultural Experiment Stations, respectively. Commercial seed in some areas is made up largely of this type, and it is almost always found to some extent in fields of common flax. These short fiber flaxes have more slender stems than flax of the seed type. They have fewer basal branches and a more compact panicle (head), nearly level on top. This type is earlier than the seed flax.

The seed flaxes have a longer period of blooming than the short fiber flaxes. The panicles have many branches and are uneven at the top. To this type belong North Dakota Resistant Nos. 52 and 73, the so-called Russian flax (North Dakota No. 155), and the selections from the latter strain distributed by the North Dakota Agricultural Experiment Station, as well as several importations from Russia grown experimentally in the Northwest. Most of the commercial flax varieties are true seed flaxes but contain mixtures of the short fiber flax. The large-bolled, large-seeded flaxes, which are numerous in occasional fields, doubtless had their origin in commercial importations of seed from Argentina. Except in size of bolls and seeds these closely resemble the Russian seed flax.

In cool, cloudy weather the seed flaxes continue to bloom for a long time and may have open flowers and green and ripe bolls on the same panicle. The short fiber type has a more definite growth period, but may make a second growth if wet weather comes about the time the crop matures.

Varietal tests at 10 stations in the northern Great Plains area for periods of three to six years show that the seed-flax varieties give

uniformly better results than the short fiber flaxes. In nearly every test North Dakota No. 155 or some selection from it has given the highest yield, while North Dakota Resistant Nos. 52 and 73 and two or three similar strains have been among the best varieties. These stations are all located west of the Red River valley in sections where flax wilt is not serious.

In the subhumid sections farther east, North Dakota Resistant No. 114 and Primost (Minnesota No. 25) have been widely distributed. They are quite similar in appearance. North Dakota Resistant No. 114 is probably the most resistant strain to both wilt and rust that can now be obtained. The yields of these two varieties of short fiber flax and of commercial mixtures containing a majority of plants closely resembling them have not been satisfactory at the 10 stations in the semiarid sections.

Figures 3 and 4 show the varietal test plats at Mandan, N. Dak., in 1914 and at Moccasin, Mont., in 1915. These give an idea of the

FIG. 3.—Panorama of flax experimental plats at the Northern Great Plains Field Station, Mandan, N. Dak., in 1914.

nature and extent of the tests. The varieties shown here are sown in duplicate in twentieth-acre plats or in fiftieth-acre plats replicated five times. By means of such replications variations in the soil are detected and no variety has an unfair advantage in the test.

GOOD SEED.

WHERE TO GET SEED.

Where seed must be purchased, try to obtain it from some one in the locality who is known to have a good-yielding strain of flax free from weeds and disease. If no such seed is available, write to the State agricultural experiment station or to the Bureau of Plant Industry of the United States Department of Agriculture. If these agencies can not supply pure seed, they can probably tell where it can be obtained.

After a good strain of flax has been secured, it should be kept pure and free from weed seeds. Select a portion of the field that is free from disease and pull out all weeds the seed of which can not be

separated from flax by the fanning mill. In this way seed flax is obtained that is (1) grown in and adapted to the locality, (2) free from admixture with weed seed that will infest the field and reduce the yield of flax, and (3) relatively free from disease which, if introduced into the soil, may become a serious menace to the flax crop.

Better seed can often be obtained by using a good, clean field for the production of seed flax. This field can be sown earlier than the larger fields, thus insuring the full development of the plants and the production of good, plump seed. If sown in rows 12 to 18

FIG. 4.—Flax varieties growing in field plats at the Judith Basin substation, Moccasin, Mont., in 1915. (From a photograph lent by the Office of Exhibits, U. S. Department of Agriculture.)

inches apart a man can walk through the field and pull the weeds without injury to the flax. Figure 5 illustrates a field seeded in this way.

CLEANING THE SEED.

Seed obtained from any source should be thoroughly cleaned with the fanning mill before sowing. A fanning mill which separates the light from the heavy seed by gravity is the most desirable kind to use. Wilt diseases live over in the chaff and immature seed and develop in the soil if such seeds are sown. Only the largest, plumpest seeds should be sown.

TREATMENT FOR WILT.

To insure further against the introduction of wilt with the seed, the formaldehyde treatment has been recommended by the North

Dakota Agricultural Experiment Station.[1] The seed is disinfected with a solution composed of 1 pound of commercial formaldehyde of standard strength (37 per cent) to 40 gallons of water.

Too much water should not be applied to the seed in this treatment. The mucilaginous seed coat swells rapidly and becomes sticky when damp. Use care in applying the solution or the seed will cake together in large lumps. Care should also be taken not to make the solution too strong, as there is danger of killing the seed.

The seed should be spread on a floor or tarpaulin already disinfected. The solution should then be applied in a fine spray with a force pump. If a force pump is not available, any convenient

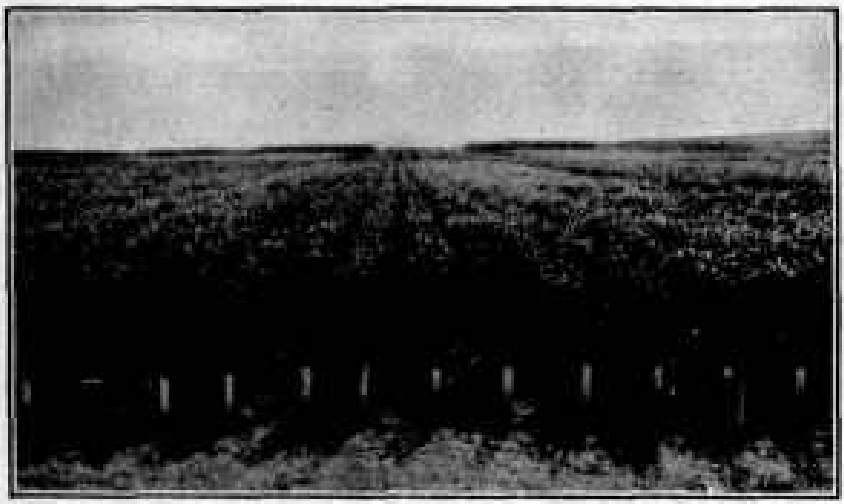

FIG. 5.—Flax selections growing in 8-rod rows 12 inches apart at the Northern Great Plains Field Station, Mandan, N. Dak., in 1915. Each row has been increased from a single plant selected in 1913.

method by which the moisture may be applied evenly and in not too great quantity may be used. The seed should be stirred constantly while being sprayed, in order that the moisture may come in contact with all of it and still make no portion damp enough to cake. A half gallon of water is sufficient for each bushel of seed. After treatment, the seed may be left in a pile and covered with canvas or sacks which have been treated.

Sometimes the seed is treated in a wagon box or a box light enough to be carried about in the field. It is then drilled immediately after treating, before it has any chance to cake.

[1] Bolley, H. L., and Wilson, M. L. Cropping to flax on new lands of semiarid land areas. N. Dak. Agr. Exp. Sta. Bul. 103, 57 p., 27 fig. 1913. Also published as Mont. Agr. Exp. Sta. Circ. 22. 1913.

ROTATIONS FOR FLAX.

Up to the present time the bulk of the flax crop has been raised on breaking. Because of the high value of the seed per pound as compared with other grain, it makes an excellent crop for the homesteader who must haul his grain a long distance to market. Flax seems to be better adapted than any other crop to rotting prairie sod in preparation for succeeding crops. It has the further advantage of being a quick-growing crop. In the Dakotas and Montana the homesteader can continue breaking his land until the second week in June and still sow it to flax with fair assurance of a crop sufficiently large to pay at least for the breaking.

Where flax is sown on old land it should be grown in rotation with other crops. This is particularly necessary because of diseases which develop in the soil when the crop is grown continuously on the same land. These diseases often are introduced with the seed. In some sections they increase to such an extent that flax can not be grown, while in others they appear to have little effect. Trouble from flax diseases can be avoided largely if the flax crop is handled properly and is grown in a rotation which includes a cultivated crop. Where flax wilt is known to be present, flax should not be grown on the same field more than once in every five or six years, unless resistant varieties are used. Good farmers no longer grow the same crop continuously on a field if it can be avoided. Each farmer must work out the rotation which will most nearly meet his needs. For this reason no attempt to outline definite rotations is made in this bulletin.

Flax grown as the cash crop in a rotation should follow the cultivated crop or summer fallow if these are kept free from weeds. When such crops or fallow are cultivated properly and the weeds are destroyed, moisture is conserved. By seeding time the land is usually filled with water to a good depth. Flax is a shallow feeder. It will do well under favorable conditions of moisture and in a firm seed bed, while the water it uses will be largely replaced before the next crop is sown. In semiarid sections it can then be followed by one of the small-grain crops which take their water from greater depths. This crop will have the advantage of the winter and seasonal rainfall plus the moisture left in the subsoil by the flax the previous year. In this way flax is produced under the most favorable conditions and the water stored by the cultivated crop is saved and used to the best advantage.

Where Russian thistle, tumbleweed, wild oats, or pigeon grass are abundant, some small grain should precede the flax, as this crop is a poor weed fighter.

In the semihumid areas, where clover, alfalfa, or grass is included in the rotation, flax can often be used as the nurse crop. Its erect habit and small leaves do not shade the young grass and clover plants

as much as other grains having a rank growth. If some other grain is used as the nurse crop, flax is often a good crop to sow when the sod land is broken. Weeds are not likely to be so troublesome when flax is grown at this period in the rotation.

Although flax is seldom seeded in mixtures with other grains, it sometimes volunteers in the succeeding crop if this is stubbled in on the old flax land. In areas where winter wheat is grown, if winter-killing has caused poor stands of the wheat, flax is sometimes sown on the land in the spring and the two crops are grown as a mixture. With reasonable care in thrashing and cleaning, both crops can be saved and marketed separately.

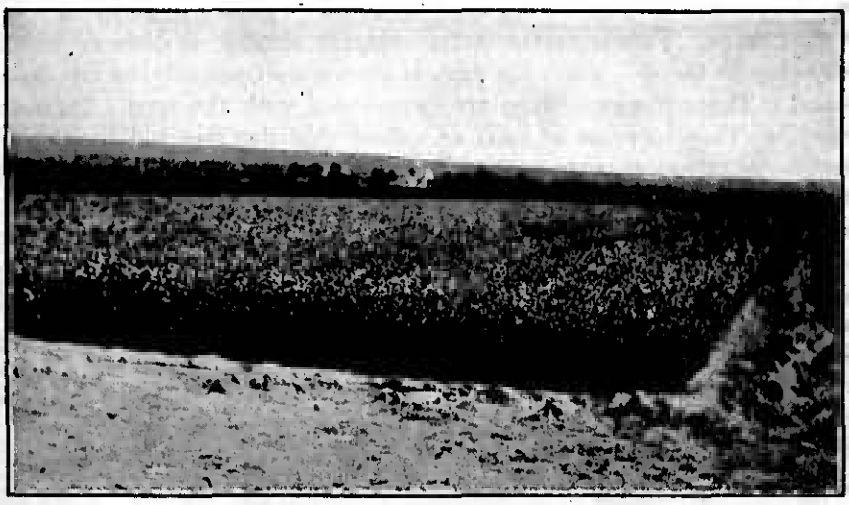

FIG. 6.—Flax on irrigated land on the Huntley Reclamation Project Experiment Farm in 1913. This plat yielded at the rate of 31.28 bushels per acre. (Photographed by Dan Hansen.)

On two of the irrigated experiment farms [1] of the Department of Agriculture flax has been grown continuously and in a 6-year rotation. No disease has been detected in these tests. On both farms the rotation consists of three years of alfalfa, followed by one year each of corn, flax, and sugar beets. The third-year alfalfa and the corn are hogged off. Four years' results have now been obtained in these tests. At Huntley, Mont., the average yield of flax in this rotation for the 4-year period is 25.8 bushels, the highest yield being 31.3 bushels. The average yield of the continuously cropped plats is 10.1 bushels; the highest yield, 14.5 bushels. The yield of this continuously cropped field

[1] Hansen, Dan. The work of the Huntley Reclamation Project Experiment Farm in 1914. U. S. Dept. Agr., West. Irrig. Agr. 2, 23 p., 8 fig. 1915.

Aune, Beyer. The work of the Belle Fourche Reclamation Project Experiment Farm in 1914. U. S. Dept. Agr., West. Irrig. Agr. 4, 16 p., 2 fig. 1915.

has increased each year. Figure 6 shows the 1913 flax plat in the 6-year rotation here discussed. In addition to the favorable yields of flax in this rotation the sugar beets following the flax have been one of the highest-yielding beet crops in the rotation series.

Similar results were obtained at the Belle Fourche station near Newell, S. Dak. In 1914 the flax plat in the 6-year rotation yielded 21.4 bushels, while the yield of the continuously cropped plat was 7.5 bushels. The average yield of all flax plats for three years is approximately 14 bushels.

A rotation similar to the above in the irrigated rotation series at the Scottsbluff Experiment Farm, Mitchell, Nebr., has not given as favorable results so far. Unfavorable weather conditions, however, have

FIG. 7.—A 320-acre field of North Dakota Resistant No. 52 flax on breaking, 15 miles south of Mandan, N. Dak. The average yield of this field was 15.1 bushels per acre.

affected the experiment, and the test has not been conducted for a period long enough to warrant definite conclusions.

PREPARING THE SEED BED.

If sod is broken in the fall, the land should be well packed in the spring either by heavy rolling or by disking and harrowing, or both, and the surface made as smooth as possible. The planker (plank drag) is often used for leveling and packing sod land. Spring breaking should be packed and the seed bed prepared as soon as possible, in order that the seed may be sown before the upturned sod has become dry. Figure 7 shows a 320-acre field of flax sown in this manner. A strip of sod was plowed, put into shape, and seeded. Then another strip was prepared in the same way. A clean, thrifty field of flax was obtained. Where tractor outfits are used, plowing, disking, packing, and seeding often are done in one operation. Land preparation and cropping methods under semiarid conditions have

been discussed and well illustrated in two joint publications of the North Dakota and Montana agricultural experiment stations.[1]

A firm, well-prepared seed bed is as essential for flax when it is grown in rotation after other crops as it is when it is grown on new breaking. For this reason, when flax is sown after corn, potatoes, or summer fallow on land which has been kept free from weeds, the land is not plowed. Such fields are disked and harrowed in the spring to prepare a good seed bed and are then seeded before the moist surface dries.

Where it is desired to sow flax on fields that have not been kept free from weeds the land should be plowed, or the disking delayed until the weed seed has had an opportunity to germinate. It is often better, however, to grow some other grain crop for one year before flax is sown.

Dry pasture or meadow lands usually should be broken in the fall. The breaking will catch and hold the snow, and the run-off will not be as great when the snow melts in the spring as it is from unplowed sod land.

Whether the fall or spring plowing of stubble land is best for flax varies with the conditions under which the crop is grown. In the drier areas spring plowing will usually give the best results.

Because of the fine stems, flax stubble can easily be put into good tilth for sowing another grain crop by disking. Good crops can be raised at considerably less cost if this method is followed. Flax stubble should be plowed, however, if the flax was grown on land not previously plowed.

When flax follows corn or other cultivated crops under irrigation the land is prepared by disking and harrowing, just as under dry-land conditions. If it follows a small grain, the land is usually plowed in the fall. It is generally in better shape to work in the fall and is left in better tilth. Ordinarily there is sufficient moisture in the soil, so that it is not necessary to irrigate in the spring to germinate the seed.

SOWING THE SEED.

METHOD OF SEEDING.

Flax is usually sown with an ordinary grain drill. The depth of seeding depends largely on the depth at which moisture is present, as it is desirable to sow the seed in moist soil. It should not be sown deeper than 1 inch if there is sufficient moisture for its germination at that depth.

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[1] Bolley, H. L., and Wilson, M. L. Cropping to flax on new lands of semiarid land areas. N. Dak. Agr. Exp. Sta. Bul. 103, 57 p., 27 fig. 1913. Also published as Mont. Agr. Exp. Sta. Circ. 22. 1913.

Bolley, H. L., and Wilson, M. L. Flax cropping, harvesting methods. N. Dak. Agr. Exp. Sta. Circ. 1, 32 p., 43 fig. 1914. Also published as Mont. Agr. Exp. Sta. Circ. 40. 1914.

TIME OF SEEDING.

When not grown on breaking, flax has usually heen sown as a late catch crop in the Northwest. This practice is so common that many growers have come to believe that flax should not be sown until June 1 or later. Many who have their land prepared earlier delay seeding until about this time. Although good yields are often obtained from late-sown flax, the farmer who follows this practice runs the risk of losing his crop from damage by early frosts. Contrary to common belief, flax is not easily injured by frost when young. If a hard frost occurs when the plants are just coming up some will be injured; if it occurs after they are up no material damage will result.

Tests in the northern Great Plains area for three years show that flax sown the latter part of April or the first week in May usually gives the best results. When conditions are favorable good yields are obtained from flax seeded as late as the first week of June. The early-sown flax is ready to ripen during the period of hottest summer weather. Flax sown in June seldom comes into bloom until this period is nearly over. Seedings made from May 15 to June 1 often come into full bloom when moisture conditions are very unfavorable and the hot winds dry up the plants. Under such conditions the period of hloom is usually short and the yield consequently reduced.

In the high, dry plains at altitudes of more than 5,000 feet spring rains are infrequent and the soil becomes warm slowly. Under these conditions late seeding usually gives the highest yields.

At lower altitudes on the Great Plains seeding should be done early, as soon as the seed bed is prepared and before weed seeds have time to germinate. If this can not be done, the weed seeds should be allowed to germinate and the field disked before sowing. As it is not usually desirable to sow flax in the Dakotas and Montana during the latter half of May, this disking should be delayed until late in May, so that the flax can be sown about June 1 on freshly disked land. Flax sown as late as June 1, however, often has to be cut in damp, cloudy weather and while the straw is still green, making the harvesting difficult. Such flax cures slowly and autumn rains or snow usually occur before it can be thrashed. This often reduces both the yield and quality of the crop. But where adverse weather conditions delay seeding or late seeding otherwise seems desirable, flax is probably the money crop best adapted throughout the flax-producing area.

RATE OF SEEDING.

Where the annual rainfall is not more than 20 inches, flax need not be sown at a rate greater than 20 pounds to the acre. This should be reduced to 15 pounds under drier conditions. Where the rainfall is more than 20 inches a slightly higher yield may be obtained if 25 or

30 pounds are sown to the acre. The sowing of more than 30 pounds to the acre on dry land is of doubtful value.

Flax grown under irrigation is commonly sown at the rate of 35 to 45 pounds per acre. It is not known whether a lower rate would give as good returns.

Because of the heavy rate of seeding used where flax is grown for fiber many farmers who grow the crop for seed sow at a much higher rate than those just recommended. This high rate of seeding is unnecessary and, because of the high price of seed, is also unprofitable. Thick seeding with seed flax or short fiber flax, even in areas where fiber flax can be grown, does not produce textile fiber flax, but will probably reduce the yield of seed.

IRRIGATING THE CROP.

Comparatively little flax is grown in the United States on irrigated land. Where water is supplied, one or two irrigations during the period between emergence and full bloom will generally be sufficient. The crop will ripen more uniformly if no water is applied after it is in full bloom. Irrigations should be light. The water should be applied rapidly and as evenly as possible, so that no portion of the field may be covered for any length of time. Land not easily penetrated by water should be irrigated in the late afternoon or at night. If water remains on the field for several hours during the day the plants will be scalded. Such plants often form bolls and turn brown as though ripe, but these bolls contain little or no seed.

HARVESTING THE CROP.

CUTTING.

Flax should be fully ripe when cut. In normal seasons the stems dry and turn brown before the seed is thoroughly mature and the crop is almost cured at the time of harvest. When the season is late, cool, and wet, the stem often remains green and the plant continues to bloom till frost. Most of the bolls, however, will ripen before danger of frost makes cutting advisable. Fax cut when the stems are green requires a longer time to cure than flax with ripe straw.

On smooth land most flax can be cut and bound with a binder. By the proper adjustment of the reel and butter, bundles of fair size and shape, such as are shown in figure 8, can be made. When these are shocked the seed is kept from the damp earth. The crop dries more readily after rain and snow, and diseases do not develop as rapidly as if the flax lay flat on the ground. This is probably the most satisfactory method of harvesting flax on a small farm. The principal objection to bound flax is that if the bundles are damp when thrashed they mat together and choke the machine. This is especially likely to

happen if some of the bands are not cut. The irregular shape of the bundles makes band cutting difficult.

On large farms headers are often used with satisfactory results, the heads being stacked in long, low ricks. The plants must be ripe when headed or the flax will heat and reduce the quality of the seed. The combined harvester and thrasher also may be used, though this is difficult to regulate so the flax can be thrashed to advantage.

Some growers remove the binder attachment from the grain binder, attach a buncher, and drop the flax bunches in a windrow. Sometimes the binder attachment is removed but no buncher is used. The flax is then bunched with the bundle carrier or it is allowed to fall in a continuous windrow. These methods are not satisfactory. Reapers

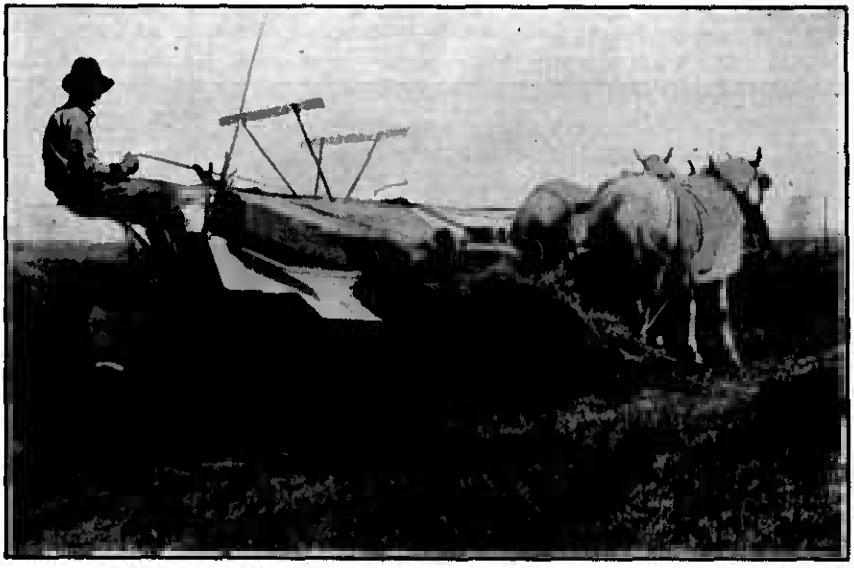

FIG. 8.—Cutting flax with a binder. By a proper adjustment of the machine most flax can be bound with little difficulty.

and mowers with bunching attachments also are utilized. All of these methods leave the flax panicles and bolls on the ground, where they readily become damp. Under these conditions fungous diseases multiply easily. This increases the disease in the soil and on the seed and straw and reduces the grade of the flax. For these reasons, every effort should be made to keep the flax crop as dry as possible before thrashing.

SHOCKING OR STACKING.

If the flax is bound it should be shocked in long shocks only two bundles in width, such as are shown on the title page. The bundles are very compact and will not dry readily after rain if wider shocks

are made. Where the flax is not bound, at least that intended for seed should be thrown into small stacks and covered with hay, straw, or tarpaulin as a protection from rain.

THRASHING.

Flax is usually the last crop thrashed on the farm, as it is often not ready when the other thrashing is done. Because the separator must be specially adjusted for flax, thrashermen usually prefer to thrash all other grain before beginning on the flax crop. Flax, therefore, is often subjected to much bad weather. If it has been shocked and stacked or otherwise protected from the fall rains, the bolls will be dry and in good condition. If the heads are damp, the seed is not easily beaten from the bolls and a considerable portion of it goes over with the straw.

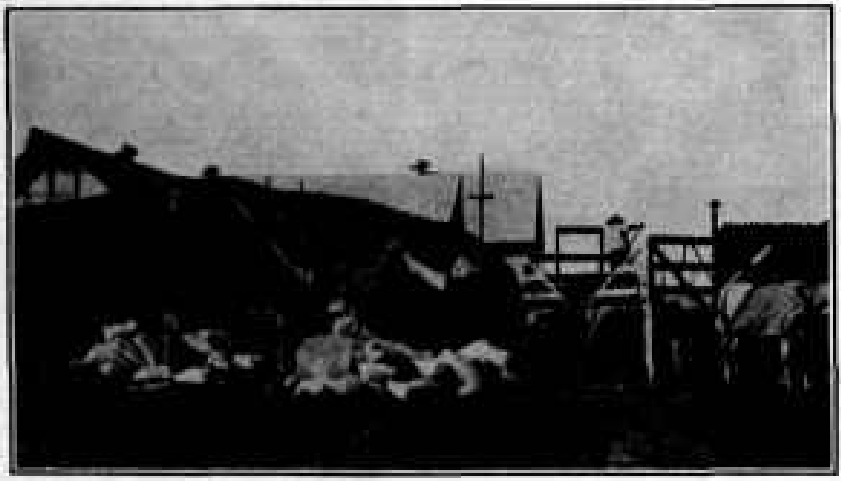

FIG. 9.—Thrashing flax at the Northern Great Plains Field Station, Mandan, N. Dak., in 1914. This machine is thoroughly cleaned after each variety is thrashed.

Where a portion of the flax field has been carefully saved for seed, the thrashing machine should be thoroughly cleaned before the crop from this portion is thrashed. This is particularly necessary if the separator has been used in thrashing diseased or weedy flax. All seed should be removed from the top of the concave plates, from the return spouts, grain elevators, beaters, and screens and from beneath the cylinder. If the quantity to be thrashed is small, the grain elevator should be removed, especially if small quantities of two or more varieties are being thrashed. After the machine has been cleaned thoroughly, it should be run empty with the wind blast turned on full to blow and shake out any seeds that have lodged in inaccessible places. Figure 9 shows a small thrasher used in thrashing varietal

plats of flax. The grain elevator is not used, and between the thrashing of two varieties the machine is cleaned in the manner indicated.

Many thrashers try to clean the flax too well as they thrash it. This usually results in blowing much good seed over with the tailings. This, together with what goes over with the straw unthrashed, often decreases the yield materially. In order to obtain all the seed it is necessary to admit some dirt. The farmer is not given a poorer grade for the dirty seed. He is docked for the actual amount of dirt in the seed, and the grade and price are determined from the cleaned sample. If growers were generally aware of this fact there would be less seed fed or burned with the straw.

STORING THE SEED.

Where flax is stored for seed it should first be cleaned. Only the plump, sound, dry seed should be saved. This will reduce the danger of heating and also the development of disease from the chaff and immature seed, upon which the disease spores are readily carried.

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